

PREDICTING FIRST-GRADE READING ACHIEVEMENT

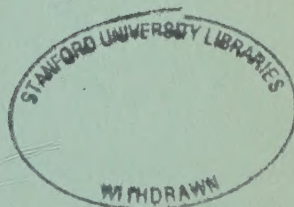
A STUDY IN READING READINESS

BY

ERBY CHESTER (DEPUTY

L. C.

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY IN THE FACULTY
OF PHILOSOPHY, COLUMBIA UNIVERSITY



BUREAU OF PUBLICATIONS
Teachers College, Columbia University
NEW YORK CITY
1930

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E. C. D.



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PREDICTING FIRST - GRADE READING ACHIEVEMENT

CHAPTER I

INTRODUCTION

Recent investigations have emphasized the importance of reading ability in determining the promotion of pupils in the primary grades. Reed¹ found that progress in reading is the basis upon which first-grade and second-grade promotion is usually determined. Percival² in a study of school failures which included 9,931 children attending city and rural schools in California found that there were more failures in reading than in any other subject. He concluded that reading was responsible for 99 per cent of the failures in Grade 1 in the cities and for 95 per cent of the failures in Grade 1 in the rural schools. Other studies³ have contributed new knowledge of the nature of word perception. According to these studies, word perception depends to a large extent upon the ability to select certain characteristics of a word by which it may be recognized, the characteristics used to identify the words frequently varying with the situation in which the word occurs. The ability to recognize words by such characteristics as length, general configuration, the peculiar shape of a letter, and the like depends upon the formation of certain perceptual habits. The beginning lessons in reading are considered especially important in the formation of the proper habits of word perception. Hence, instead of the crucial period in the development of a child's reading ability coming a semester, a year,

¹ Reed, Mary M., *An Investigation of Practices in First Grade Admission and Promotion*. Contributions to Education, No. 290. Bureau of Publications, Teachers College, Columbia University, 1927.

² Percival, W. P. *A Study of the Causes and Subjects of School Failure*. University of California Printing Office, Berkeley, California, 1926.

³ Gates, A. I. and Boeker, Eloise, "A Study of Initial Stages in Reading by Pre-School Children," *Teachers College Record*, Vol. 24, November 1923, pp. 469-88. Meek, L. H., *A Study of Learning and Retention in Young Children*, Chap. IV. pp. 50-60. Contributions to Education, No. 164, Bureau of Publications, Teachers College, Columbia University, 1925.

or two years after he has begun the study of reading, the first four or five lessons may be the most important ones for the purpose of developing the proper habits in perceiving words.

If reading is the most crucial subject in the primary grades, and if the beginning lessons are the most important ones in building up proper reading habits, then it becomes highly desirable to know which pupils are going to have difficulty in learning to read, preferably before they start to study reading. Pupils are frequently put into sections on the basis of their scores in mental tests with the expectation that those in any one section will progress at approximately the same rate in their school work. In order to give some indication of the extent to which we can expect pupils' reading achievement, as measured by scores in reading tests, to correspond to their scores in mental tests, Table 1, which summarizes several correlations between reading tests and mental tests, was constructed.

TABLE 1
SUMMARY OF SEVERAL STUDIES REPORTING CORRELATIONS BETWEEN INTELLIGENCE AND READING SCORES *

AUTHOR	GRADES	NO. OF PUPILS	READING TESTS USED	INTELLIGENCE TESTS USED	CORRELATION BETWEEN READING AND INTELLIGENCE
True	IV-VIII	218	Monroe, Curtis, and Burgess Silent Reading Tests; Reading Test of Illinois Examination	Illinois Examination, Otis Group Intelligence Scale, Binet-Simon Intelligence Scale	-.10 to +.87
True	IV-VIII	218	Same as above	Binet - Simon Intelligence Quotient	+.50
Madsen ..	VB, VIB, VIIB		Thorndike Scale, Alpha 2	Terman Group Test of Mental Ability	+.53
Hilliard ..	V	5 classes	Four reading tests (Names not given)	Three intelligence tests (Names not given)	+.38 to +.90

* This table was constructed from data reported by W. S. Gray in *Summary of Investigations Relating to Reading*, pp. 45-46. University of Chicago Supplementary Educational Monographs, No. 28, 1925.

TABLE 1—(Continued)

AUTHOR	GRADES	NO. OF PUPILS	READING TESTS USED	INTELLIGENCE TESTS USED	CORRELATION BETWEEN READING AND INTELLIGENCE
Theisen ..	I, II	200	Haggerty Reading Examination, Sigma 1	Haggerty Intelligence Examination	+ .84
Theisen ..	VIIB	Classes in 14 schools	Monroe's Standardized Silent Reading Test	Illinois Examination	+ .44
Gates ...	Several grades		Five reading tests (Names not given)	Two intelligence tests (Names not given)	-.02 to + .69
Merrill ..		210 retarded pupils	Haggerty Reading Examination, Sigma 1, Test 1	Stanford-Binet	+ .618
Merrill ..		210 retarded pupils	Sigma 1, Test 2	Stanford-Binet	+ .338
Merrill ..		210 retarded pupils	Kansas Silent Reading Test	Stanford-Binet	+ .542
Merrill ..		210 retarded pupils	Thorndike Scale, Alpha 2	Stanford-Binet	+ .486
Merrill ..		210 retarded pupils	Merrill Reading Test	Stanford-Binet	+ .498
Hewes ..		1,007 retarded pupils	School records in reading	Stanford-Binet Mental Age	+ .68

The table shows that there is a wide range in the correlations between the mental tests and the reading tests. The correlations between the group mental tests and the reading tests are higher, in general, than the correlations between the Binet and the reading tests. This is doubtless due to the fact that reading ability is required for success in the group mental tests.

W. S. Gray ⁴ comments concerning the relation between level of intelligence and progress in reading.

⁴ Gray, W. S. *Summary of Investigations Relating to Reading*, p. 51. University of Chicago Supplementary Educational Monographs, No. 28, 1925.

The studies referred to in this section show clearly that progress in reading depends to a considerable extent on the level of intelligence of the learner. It is clear that this factor must be taken into consideration in providing for individual differences. The fact that pupils at the same intelligence level do not advance equally rapidly shows that factors other than intelligence determine progress in reading. . . . Ability grouping merely eliminates one variable and simplifies the problem of teaching. There is need of investigations to determine whether this is the most important variable to control or eliminate.

In another study ⁵ Gray is quoted by Oglesby as follows:

The overlapping of 70 per cent in reading achievement between bright and medium pupils, of 43 per cent between medium and slow ⁶ pupils, and of 30 per cent between bright and slow pupils indicates that there are factors other than intelligence which must be considered in teaching primary pupils to read.⁶

These studies indicate that there is considerable difference between pupils' attainment on mental tests and their achievement in reading. Oglesby ⁵ suggests that some of the factors which account for this difference are: health, attendance, nationality of the pupils, attitude toward school work, ability of teacher, quality of materials used in teaching, and method of instruction. Doubtless some or all of these factors operate to produce part of the difference between mental status and reading achievement, but there is also the possibility that the ability demanded for success in intelligence tests is not identical with the ability necessary for achievement in reading. If this is true, then in order to predict reading achievement we need a test in addition to, or in place of, the mental test.

There have been a few attempts to predict achievement in beginning reading in which mental tests, as such, were not used as the basis of prediction. Smith ⁷ gave a series of letter- and word-matching tests to 200 children during their first two weeks in school. The correlation between their scores in the matching tests and their scores on the Detroit Test of Word Recognition given at the end of twelve weeks was .87. Winch,⁸ in studying

⁵ Oglesby, Eliza F. "A Study of Achievements in Reading of X, Y, and Z Groups," *Detroit Journal of Education*, April 1922, pp. 57-63.

⁶ Bright, medium, and slow as determined by their scores on intelligence tests.

⁷ Smith, N. B., "Matching Ability as a factor in First-Grade Reading," *Journal of Educational Psychology*, Vol. 49, November 1929, pp. 560-71.

⁸ Winch, W. H., "Teaching Beginners to Read in England. Its methods, Results and Psychological Bases," *Journal of Educational Research Monographs*, No. 8, 1925.

beginning reading, gave a test which consisted in associating a nonsense syllable with symbols similar to those used in the test of visual-auditory association described in Chapter III. He concluded that this furnished an adequate basis for dividing pupils into groups that were later found to be equal in reading achievement. Berry⁹ describes the development of a word-discrimination and a picture-vocabulary test which was successfully administered to several hundred kindergarten children and which correlated well with primary intelligence tests, but the extent to which it predicts later success in reading remains to be determined.

The present investigation is an attempt to develop a test that can be used instead of, or in connection with, a test of intelligence for the purpose of determining which pupils have the ability necessary to be successful in the first semester of reading. In other words, it is an attempt to study reading readiness.¹⁰

The number and complexity of the factors upon which success in reading depends are so great that a single study can consider only a small part of them. For instance, it is more than probable that such factors as interest in stories and pictures, the number of stories known, the proneness to conversation, or other aspects of the child's verbal life which are not considered in this study are important in a study of reading readiness, but a consideration of these would constitute a study in itself.

⁹ Berry, Frances M., "The Baltimore Reading Readiness Test," *Childhood Education*, Vol. 3, January 1927, pp. 222-23.

¹⁰ By hypothesis, reading readiness is determined by the stage of development of those mental functions (using mental function as defined by Thorndike in his *Educational Psychology, Briefer Course*, p. 176) necessary for later achievement in reading.

CHAPTER II

PROCEDURE

The children who entered the first semester of the first grade in Public School 210 Brooklyn, New York City, in February, 1929, served as subjects for this study. In all there were 165 children. Of these, 8 withdrew from school before the first series of tests was completed, 3 who would not take the tests voluntarily were not tested, and 17 were eliminated from the study because it was necessary to alter one of the tests after they had been tested. Of the remaining pupils, 21 who were taking the first semester's work for the second time were tested, but their test scores do not enter into the calculations except in the determination of the reliability of the tests. Thirteen of the remaining pupils were absent when one or more of the series of tests were given, leaving complete data for 103 of the 165 children who entered the first grade. Approximately one-half of the children had attended kindergarten for varying lengths of time but none of them had had any formal reading instruction in school. The assistant principal estimated that 95 per cent of the pupils attending this school were of Jewish parentage. The fathers of most of the children were proprietors or clerks in small stores of Brooklyn and New York City.

The pupils were divided into four sections according to their scores on the Pintner-Cunningham Mental Test. Section 1 was composed of pupils whose scores fell in the highest twenty-five per cent; section 3, pupils in the next highest twenty-five per cent; section 4, the next highest twenty-five per cent; and section 2, pupils in the lowest twenty-five per cent. The personnel of sections 1 and 3 remained practically constant throughout the semester. Section 4, which was called the "open" section, received the late entrants who had no difficulty in speaking English and whose mental ability was such that they should be able to learn reading. The late entrants who either spoke a foreign language or had mental ability so low that they could scarcely learn to

read were placed in section 2. When the semester began the teachers reported only one child who did not speak English. During the semester the personnel of sections 2 and 4 changed considerably. Six or seven children who spoke only a foreign language entered section 2, and ten or twelve late entrants entered section 4. Although only those children who were enrolled at the beginning of the semester are included in the report of this investigation, it is probable that the change of personnel of sections 2 and 4 caused the teachers' ratings of reading ability to be less accurate.

All sections used the same textbook and followed the same method in their reading work. The only difference in the reading work of the different sections was in the rate of progress through the material. The main features of the method used in the teaching of reading in the first grade of this school may be summarized somewhat as follows: a background for the story to be taught is formed by discussing the child's past experiences which relate to the incidents of the story; the teacher then tells the story to the class; following this the children re-create the story in words or by dramatizing certain parts; sentences representing parts of the story re-created are pointed out to the pupil; the sentences are then analyzed into word groups; following this the word groups are analyzed into words and the words, in turn, are analyzed into parts or phonetic elements. Certain words which are selected for mastery are drilled upon by means of blackboard and flash-card exercises until they can be quickly recognized.

The attitude of the children throughout the entire testing program was excellent. The tests were always referred to as games, and the taking of the individual tests was made a voluntary matter on the part of the pupil. When the examiner went to the classroom a child was called by name and asked if he did not want to play the game at that time. Only three of the 157 children available for testing were unwilling to go with the examiners. The surroundings for giving the tests were good, each examiner having a private room in which to test. All tests were carefully scored by the writer and were checked by a competent assistant.

There are certain factors involved in the study, depending upon the age of the children studied and the practical situation in which the study was made, which are difficult to control. For

instance, the competence of the four teachers undoubtedly varied considerably, yet it was not possible to allow for this variable in the investigation. Furthermore, it is a well-known fact that young children are not consistent in the effort and interest they put forth in testing situations. This is especially true in the case of the group tests. The lack of uniformity of effort in test situations may cause the correlations between the tests to be lower and in some instances may account for the extreme discrepancies in a child's relative standings in different tests.

The claim may be made that had the reading progress of the pupils been followed for a period longer than a semester the results of the study would be changed. To what extent this contention could be substantiated is a question. Nevertheless, it is usually found that children maintain, to a marked degree, the same relative standing throughout the grades in a subject like reading. However this may be, the object of this study is to determine as accurately as possible which pupils will, and which will not, succeed in the first semester of first-grade reading. Consequently one semester is sufficient length of time to follow the reading achievement of the pupils with which this study deals.

Four individual tests and one group test were used for studying reading readiness. The individual tests were: (1) a test of word selection, (2) a test of visual-auditory association, (3) a test of visual-visual association, and (4) a test of content comprehension and recall. These tests were constructed for, or adapted to, this study after an extended survey of tests that might be used. The group test used was the Pintner-Cunningham Primary Mental Test.

The four individual tests were given at one sitting and required forty-five minutes, on the average, for each child. They were administered by two persons—a student who had had several years of teaching experience and some graduate courses in psychology, and the writer. The tests were given during the second, third, and fourth weeks after the children entered the first grade.

CHAPTER III

DESCRIPTION OF TESTS USED TO STUDY READING READINESS

A TEST OF WORD SELECTION ¹

The test of word selection is composed of forty-eight exercises arranged in an approximate order of difficulty. Each exercise consists in selecting from a group of words or letters one that will match a given word or letter, as the case may be. The first, ninth, sixteenth, and thirty-first exercises are reproduced in Figure I. Following are the directions for administering this test:

With a blank sheet of paper cover all but the exercise at the top of the first sheet. Point to the letter "A" at the left and tell the child to make a mark around it. Then say, "Look at all of these along here (indicating the remainder of the row with the finger), find one exactly like this one (pointing to the encircled "A" at the left) and make a mark around it." If the child draws a mark around the wrong letter in this exercise point to each letter and ask if it is like the first letter encircled. That is, any error that the child makes in the first exercise should be corrected.

After the correct response has been secured for the first exercise, note the time and have the child move the blank sheet of paper down so he can see the next exercise. Point to the first letter and say, "Make a mark around this." When the letter has been encircled, say, "Find another one exactly like it and make a mark around it." After the child has done four or five exercises he usually proceeds without much supervision but occasionally there is a tendency to encircle the first word in the exercise without considering the remaining words. In such instances the examiner should point to the whole row and say, "Be sure to look at all of the words and find one exactly like this one" (indicating the one encircled at the beginning of the exercise). The child is allowed to work for fifteen minutes or until he has made five errors in succession.

The score on the test is the number of responses correct.

From an administrative point of view this test seemed to be well adapted to this group of children. No one made zero and no one had sufficient time to attempt all of the forty-eight items.

¹ This test was constructed by A. I. Gates and is published by the Bureau of Publications, Teachers College, Columbia University.

A	O	R	A	S	B
sing	ring	rung	song	sing	many
round	ground around	round sound	drang dower	mound anoint	soured frown
necessary	uncertain meanwhile necissary	necessary moonlight universal	machinery worthless nexessary	necessity neccesary newspaper	

[Reduced to $\frac{4}{5}$ actual size]

Figure I. FIRST, NINTH, SIXTEENTH, AND THIRTY-FIRST EXERCISES OF GATES VISUAL PERCEPTION TEST

The first two columns² in Table 2 give the frequency distribution of the scores for this test. The highest possible score on this test is 48. The highest score obtained is 31, the lowest 4, and the mean score is 17.30. The standard deviation is 5.86.

A TEST OF VISUAL-AUDITORY ASSOCIATION³

A symbol that could be reproduced easily by a first-grade pupil was drawn on each of ten cards 2½ by 4 inches in size. Ten words which, in the judgment of the writer, referred to objects or activities common to the experiences of the children were selected. (An attempt was made to choose words which would be of some interest to the children tested.) The test consisted in associating a spoken word with a visual symbol. The investigator hoped that there would be some relation between ability in this

² Interpretation of data pertaining to other tests listed in the table will be evident after reading the discussions of the various tests following the table.

³ Suggestions for this test were obtained from certain tests described by A. I. Gates in his book, *The Improvement of Reading: A Program of Diagnostic and Remedial Methods*.

TABLE 2

FREQUENCY DISTRIBUTION FOR THE TESTS OF WORD SELECTION, VISUAL-AUDITORY ASSOCIATION, VISUAL-VISUAL ASSOCIATION, CONTENT COMPREHENSION AND RECALL, AND PINTNER-CUNNINGHAM PRIMARY MENTAL TEST

WORD SELECTION			VISUAL-AUDITORY ASSOCIATION			VISUAL-VISUAL ASSOCIATION			CONTENT COMPREHENSION AND RECALL			PINTNER-CUNNINGHAM		
Score	Frequency		Score	Frequency		Score	Frequency		Score	Frequency		Score	Frequency	
30-31	2	20	2	15	2	26-27	2	42-44	1			42-44	1	
28-29	0	19	7	14	0	24-25	0	39-41	0			39-41	0	
26-27	2	18	1	13	0	22-23	0	36-38	2			36-38	2	
24-25	8	17	2	12	2	20-21	2	33-35	5			33-35	5	
22-23	14	16	6	11	1	18-19	1	30-32	10			30-32	4	
20-21	17	15	14	10	3	16-17	3	27-29	15			27-29	6	
18-19	10	14	6	9	5	14-15	5	24-26	8			24-26	7	
16-17	11	13	12	8	10	12-13	10	21-23	14			21-23	9	
14-15	9	12	7	7	10	10-11	10	18-20	10			18-20	11	
12-13	9	11	11	6	12	8-9	12	15-17	14			15-17	16	
10-11	11	10	5	5	19	6-7	19	12-14	5			12-14	22	
8-9	4	9	8	4	9	4-5	9	9-11	1			9-11	14	
6-7	1	8	7	3	6	2-3	6	6-8	8			6-8	4	
4-5	5	7	1	2	12	0-1	12	3-5	2			3-5	3	
		6	4	1	4		4	0-2	4			0-2	1	
		5	6	0	8		8						3	
		4	1											
		3	0											
		2	2											
		1	1											

Word Selection		Visual-Auditory Association		Visual-Visual Association		Content Comprehension and Recall		Pintner-Cunningham	
Number of cases	103	103	103	103	103	103	103	103	103
Total possible score	48	20	20	20	32	32	56	56	56
Mean score	17.30	12.38	5.73	14.88	14.88	19.98	19.98	19.98	19.98
Standard deviation	5.86	4.32	3.16	6.32	6.32	8.01	8.01	8.01	8.01

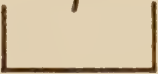
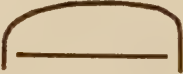
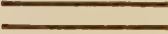
<i>Card *</i>	<i>Symbol</i>	<i>Word</i>
(Number 1)		run
(Number 2)		auto
(Number 3)		play
(Number 4)		dog
(Number 5)		boy
(Number 6)		snow
(Number 7)		school
(Number 8)		girl
(Number 9)		milk
(Number 10)		candy

Figure II. SYMBOLS AND WORDS USED IN TEST OF VISUAL-AUDITORY ASSOCIATION

* Each card was numbered on the side opposite the symbol to facilitate scoring.

test and the child's ability to associate spoken words with printed words in his reading work. The symbols and words to be associated with them are given in Figure II.

The directions for giving this test are as follows:

Show the child any one of the ten cards and say, "See this little 'picture'? We are going to play like it says" (naming the word that is to be associated with the symbol on the card). Have the child repeat the word. Then say, "You draw the 'picture.'" Ask the child what the 'picture says' just as he completes the drawing. Now say to the child, "I am going to put this card over here (close to the examiner so the child cannot see it) while I show you the rest of them but you must try to remember the 'picture' so you can tell me what it says the next time I show it to you." Proceed with the other cards in the same way. Most children make the drawings rapidly but in case a child should take too much time trying to correct little faults encourage him to make the drawings quickly.

After the ten cards have been presented to the child in the manner described above, they should be shuffled so as to change the order and then shown to the child one at a time, each time asking, "What did this 'picture say'?" Allow the time required to count to six, at the rate of one per second, for a response. If he has not answered then say, "This 'picture says'" (giving the word that is to be associated with that symbol). If the child gives a wrong reply for a symbol, say, "No, this picture says" (giving the correct word for the symbol). Showing the cards to the child one at a time and asking what the "picture says" constitutes a test. Four tests should be given.

Each card is numbered on the back to facilitate keeping the score. A score sheet similar to the one illustrated in Figure III is provided for each child. The numbers across the top of Figure III correspond to the numbers on the backs of the cards. The numbers in the column on the left represent the number of times the cards are shown. When a correct response is given make a check in the square that corresponds to the number of the card and the number of the test being given.

Figure III represents the score sheet for both the visual-auditory and the visual-visual association tests. The numbers across the top of Figure III represent the numbers on the backs of the cards. The numbers in the column on the left represent the number of times the cards were shown. The score sheet provides for a fifth showing because in the test of visual-visual association the pupils are shown the cards five times for the purpose of testing their associations. Of the four individual tests, the test of visual-auditory association appeared to be the most interesting to the children.

Three methods of scoring were tried: (1) the total number of

NUMBER ON THE TEST CARD

TEST	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										

Figure III. SCORE SHEET FOR THE TESTS OF VISUAL-AUDITORY AND VISUAL-VISUAL ASSOCIATION

check marks (correct responses) on the four showings of the cards, (2) the number of check marks on the third or fourth showing, depending upon which was the larger, and (3) the sum of the check marks on the third and fourth showing. The third method gave the highest correlation with scores on tests of reading ability and was chosen as the method of scoring.

The frequency distribution of the scores on the test of visual-auditory association is given in Table 2. The highest possible score for this test is 20. The highest score obtained is 20 and the lowest score is 1. The mean score is 12.38 and the standard deviation is 4.32.

A TEST OF VISUAL-VISUAL ASSOCIATION.⁴

This test was made up of ten cards $2\frac{1}{2}$ by 4 inches in size. A small picture⁵ was pasted on one side of each card. The pictures used were as follows: card number 1 contained the picture of a table; card number 2 contained the picture of a flag; card number 3, a hand; card number 4, a fish; card number 5, a top; card number 6, a train; card number 7, three bells; card number 8, a bed; card number 9, a clock; card number 10, an airplane. The

⁴ Suggestions for this test were obtained from A. I. Gates, *Improvement of Reading: A Program of Diagnostic and Remedial Methods*.

⁵ The pictures were taken from *Gates' Primary Reading Test*, Type 2, Forms 1 and 2. Bureau of Publications, Teachers College, Columbia University, 1926.

name of the picture was printed underneath it and again on the reverse side of the card. The task consisted in associating the name of the picture with the picture, so that when the opposite side of the card was turned the child would recognize the word as it stood by itself.

The directions for giving this test are as follows:

Cover up the word on the card and ask the child what each picture is. This is done to see if the child has any difficulty in recognizing the pictures. In case he does not know what one of the pictures is, tell him. Then explain that below each picture is a word, that the picture tells what the word "says," and that, after he has looked at all the pictures and words on the side of the cards you are showing him, you are going to show him just the words (turn the card over so he can see the word on the opposite side) to see if he can remember what the words "say." The cards are then shown; each one exposed while the examiner counts, at the rate of one per second, to six. This constitutes one presentation.

The child is now shown the word on the back of each card and asked, "What did this word say?" Allow the time required to count to six, at the rate of one per second, for a response. If the child has not responded at the end of this interval, the examiner turns the card around so the child can see the picture and says, "This is what this word 'says.'" Going through all the cards in the manner just described constitutes one test.

The examiner should not say the words out loud either in the presentation or in the tests. The child should not speak the words except in answer to the question, "What does this word 'say'?" Some children study the test by whispering the words to themselves. This should be discouraged, but it may not be possible to eliminate such responses entirely.

After the first test the child is again shown the pictures and words in the same manner as described in the beginning. This constitutes a second presentation. In each presentation the examiner should say to the child, "Be sure to look at both the word and the picture," for each of two or three cards. This will prevent the child from looking at only the picture. Following the second presentation four tests in succession are given. This makes five tests and two presentations in all.

The responses are recorded by making a check mark in the square corresponding to the number of the card and the number of the test being given, as in the visual-auditory association test.

By correlating the scores of this test with the final reading scores it was found that the best method of scoring the test was to take the sum of the correct responses in the fourth and fifth showings. The frequency distribution of the scores for this test is given in Table 2. The highest score made is 15, the lowest is 0, and the mean score is 5.73. The standard deviation is 3.16, and the highest possible score is 20.

The visual-visual association test proved to be the most difficult of the four individual tests. When the test was constructed the writer hoped that the children would be able to select some characteristic of the word, such as length, general configuration, or the peculiar shape of a letter, and use it in forming their association between the word and the picture. Judging from the difficulty of the test, either the children did not have marked ability in using cues to form their associations or they did not hit upon that method to a very great extent. In order to throw some light on the methods used in learning these words, some of the children were asked how they knew certain words. Four out of five children who were asked how they knew the word "airplane" said they knew the word because it was the long word. Of six children who were asked how they knew the word "clock," two answered by pointing to the letter "k," two pointed to the letter "c," and two pointed to the letter "o." All four of the children who were asked how they knew the word "flag" replied by indicating the letter "g." These replies corroborate the findings of other studies^a that children use certain characteristics of words as a means of forming cues by which to learn them, at least to a certain extent.

A TEST OF CONTENT COMPREHENSION AND RECALL

In the test of content comprehension and recall, the child listened to the examiner read a story and then repeated in his own words as much of the story as he could remember. The story was composed, rather than selected from existing stories, in order to avoid choosing one with which some of the children might be familiar. The story was as follows:

A little | girl | went to the store | to buy | some candy. | On her way home | she saw | one of her friends | skating | on the sidewalks. | She gave her | some candy | and put the sack | on the ground | while they played. |

A big | black | dog | came | around the corner | and saw the candy. | He took it | and ran away | as fast as he could. | The little | girls | looked up | just in time | to see | what had happened | to their candy. |

The directions for giving the test are:

The examiner says to the child, "Do you like to hear stories? I am going to read you a nice, little story and I want you to listen very care-

^aGates, A. I. and Boeker, Eloise, "A Study of Initial Stages in Reading by Pre-School Children," *Teachers College Record*, Vol. 24, November 1923, pp. 469-488.

fully so you can tell me what the story 'says' when I am through." Read the story slowly (the reading of the story should consume from thirty to forty seconds) and distinctly. Then say to the child, "Tell me all of the story that you can remember." If the child is silent or says that he cannot tell the story, say to him, "I am sure you can tell me something the story said," or make some similar encouraging comment. If no reply can be gotten the child's score is zero.

The vertical lines divide the story into parts each of which stands for an idea. Draw lines under those parts of the story which represent ideas reported by the child. The score is the number of ideas correctly reported.

The frequency distribution of the scores in the test of content comprehension and recall is given in Table 2. The highest possible score is 32. The highest score made is 27 and there were three pupils who made 0. The mean score for the test is 14.88 and the standard deviation is 6.32.

The reliability of the entire individual examination consisting of the test of word selection, the visual-auditory association test, the visual-visual association test and the test of content comprehension and recall was computed by finding the correlation between random halves of the test and then applying the Spearman-Brown formula. The coefficient of reliability by this method is $.895 \pm .01$ for 133 cases.

THE INTELLIGENCE TEST

Seven days after these children entered the first grade they were given the Pintner-Cunningham Primary Mental Test. The test was administered by the supervisor of primary grades, a person who had had much experience in teaching and supervising primary children. She had given the Pintner-Cunningham Test each semester for a number of years to all the children entering the first grade of this school.

The frequency distribution of the scores on the Pintner-Cunningham Test is given in Table 2. The mean score is 19.98 or approximately 20. The chronological ages of the group at the time the intelligence test was given ranged from 70 to 76 months. The mean chronological age was 72.43 months. The average score of children 72 months old on the Pintner Cunningham is 23. Hence this group of children was mentally below the average of first-grade children.

CHAPTER IV

MEASURING FIRST-GRADE READING ACHIEVEMENT

GENERAL STATEMENT

After the tests described in the preceding chapter were administered, the next problem was that of measuring the reading achievement of the subjects. In this school the first-grade pupils were promoted, or failed, chiefly on the basis of the teacher's judgment concerning their achievement. The supervisor or principal, or both, made a practice of hearing each child in the first grade read and made note of his reading status, but this was more for the purpose of discovering whether the child had learned certain techniques of pronunciation and enunciation than to discover his ability to recognize words and grasp the meaning of sentences. Many studies have shown that teachers' ratings of pupil achievement do not correlate very highly with accepted objective measures. Hence, some more objective measure of reading achievement was sought.

Because individual reading tests would have necessitated considerable interruption of class work in addition to that already involved in administering the individual tests of reading readiness previously described in Chapter III, it was considered advisable to measure reading achievement by the group method. Eight of the best-known, standardized, first-grade reading tests were examined with the purpose of selecting one for measuring the reading achievement of this group of pupils. The examination revealed that in all of the tests almost all of the words were not included in the textbook used by this group. One test did not have a single word studied by these children before they were given the first reading test. Moreover, the directions with most of the tests were so complex that the test would have been too difficult even though the children had studied all the words. All the tests examined were intended for the latter part of the last semester, rather than for the first semester, of the first grade. These conditions made it necessary to construct some means of

measuring the reading achievement of these pupils in groups; consequently, a first group test of reading ability was constructed from the vocabulary studied and given at the end of the thirteenth week of the semester. A second group test of reading ability was constructed and administered during the eighteenth week of the semester. An individual test of reading ability, consisting of a passage taken from the text used, and a second passage, composed of words that had been thoroughly studied, were given to the thirty-three pupils who made the low scores on the first group reading test. A description of each of these tests follows.

FIRST GROUP TEST OF READING ABILITY¹

The first group test of reading ability consisted of four parts as follows: a test of word recognition,² a test of word recall, and two types of sentence comprehension. The test of word recognition consisted in selecting from a group of four words or phrases a word or phrase, as the case might be, designated by the examiner. For instance, the first exercise in the test of word recognition consisted in selecting the word "pig" from the group of words: "hen," "pig," "cut," and "called." The fourth exercise of this test consisted in selecting the phrase "the cat," from the group of phrases: "They went," "he did," "the cat," and "her house." There were twenty-four exercises similar to these.

The test of word recall required the pupil to find a word that fulfilled a certain condition. For instance, the second exercise contained the words: "he," "then," "cry," and "into." The child was asked to find the word that tells something a baby does. There were sixteen exercises of this type.

The first exercise in the first test of sentence comprehension² contained the three sentences: "The pig ran," "The pig said, 'Ouf,'" and "The goose said, 'Hiss.'" The task consisted in finding the sentence that told what the pig said. There were thirteen exercises of this type. The second type of sentence comprehension consisted in finding which of three words a given sentence described or referred to. For example, the third exercise of this

¹ See Appendix for this test.

² Suggestions in this connection were obtained from an unpublished study by Miss Elizabeth Long, which was done under the supervision of Dr. Bess V. Cunningham, of Teachers College, Columbia University.

test contained the three words: "lived," "goat," "house," and the sentence: "I want to eat some grass." The child was asked to indicate which of the three words the "story (sentence) talked about."

The first group test of reading ability, comprised of the four parts described above, was given during the thirteenth week after the children had entered the first grade. The reading material from which the words were chosen included only that

TABLE 3

WORDS SELECTED FOR MASTERY FROM VOCABULARY OF MATERIAL COVERED IN TEXTBOOK, TOGETHER WITH NUMBER OF TIMES EACH WORD OCCURRED IN FIRST AND SECOND GROUP TESTS OF READING ABILITY

(The words are listed in the order in which they occurred in the reading material)

WORD	FREQUENCY		WORD	FREQUENCY		WORD	FREQUENCY	
	First Group Test	Second Group Test		First Group Test	Second Group Test		First Group Test	Second Group Test
the ...	52	32	had	5	0	went	7	2
little ..	7	6	goat	15	3	soon	3	0
red ...	1	2	ran	8	1	is	9	8
hen ...	6	2	into	2	2	her	6	0
some ..	5	2	woods ..	3	1	under ...	4	1
she	11	0	he	9	0	nothing..	1	0
called..	5	0	grass	6	4	down ...	3	1
cat ...	8	2	wanted ..	4	3	chairs ...	4	2
pig ...	8	2	to	7	6	out	8	0
said ...	8	2	go	7	4	got	1	0
who ...	2	0	home ...	7	1	again ...	4	0
will ...	11	2	began ...	3	0	of	3	0
help ..	13	0	along ...	3	0	jumped..	4	1
me ...	8	1	came ...	8	1	old	6	1
not	4	1	rabbit ..	6	2	man	0	4
I	12	16	why	4	0	put	0	1
then ..	3	0	are	7	1	away	0	1
and ...	4	1	after	5	1	but	0	0
did	9	0	no	3	0	could ...	0	0
up	1	1	want	3	3	catch ...	0	1
cut ...	4	1	fox	5	1	him	0	0
make ..	4	0	there ...	11	1	met	0	0
eat ...	5	8	was	10	1	from	0	0
you ...	4	2	woman ..	8	4	can	0	15
would..	1	0	lived	5	3	run	0	3
shall ..	2	0	house ...	7	6	so	0	0
my ...	5	3	bed	8	2	dog	0	2
they ..	7	0	on	1	3	caught ..	0	0
boy ...	16	11	one	2	0	that	0	0

which had been covered by the slowest-moving section. Thus, all pupils had had an opportunity to learn any word used in the test. The classroom teacher, the writer, and two assistants gave the tests to groups ranging in number from thirty-five to forty-two. There was no time limit. When all but two or three pupils had completed the exercise the examiner proceeded with the next one. The test occupied two periods of approximately 35 minutes each, one period coming in the forenoon and the other in the afternoon of the same day for each section. At the time that the test was given the slowest-moving section had studied 112 different words, 72 of which were designated by the manual as words to be thoroughly mastered. The first 72 words in Table 3 are the ones which were to be thoroughly mastered. The second, fifth, and eighth columns of this table show the frequency with which each word occurred in the first group test of reading ability.

Table 4 gives the frequency distribution of the scores on the first group reading test. The highest possible score is 57. The highest score obtained is 57, the lowest score is 25, and the mean score is 47.04. The reliability of the test obtained by correlating the scores on the even-numbered exercises with the scores on the odd-numbered exercises and then applying the Spearman-Brown formula is $.88 \pm .01$ for 156 cases.

Since the distribution is skewed toward the higher scores and the lowest score is far above zero, the test seems to have been an easy one for the group as a whole.

Table 5 shows that this test of reading ability correlates .71 with the individual test of reading ability, .74 with second group test of reading ability, .69 with the scores on the second group test of reading ability and the Detroit Word Recognition Test combined. The average correlation between this test and teachers' ratings is .57. This is somewhat low but an inspection of the table shows that the correlations with the ratings for sections 2 and 3 was approximately .70. The correlation of .43 with the ratings for section 1 is probably due to the fact that the test was too easy for the pupils in this section and consequently the scores were not well distributed. No explanation for the low correlation with the ratings for section 4 is known except that the personnel of this section changed considerably during the period of this investigation on account of the fact that there were many late entrants.

TABLE 4

FREQUENCY DISTRIBUTION OF SCORES ON FIRST GROUP READING TEST, SECOND GROUP READING TEST, DETROIT WORD RECOGNITION TEST, AND THE COMBINED SCORES ON THE THREE READING TESTS

FIRST GROUP READING TEST		SECOND GROUP READING TEST		DETROIT WORD RECOGNITION TEST		COMPOSITE OF THREE READING TESTS	
Score	Frequency	Score	Frequency	Score	Frequency	Score	Frequency
57-58	1	42-43	2	36-37	1	128-132	1
55-56	9	40-41	0	34-35	1	123-127	1
53-54	13	38-39	2	32-33	4	118-122	4
51-52	17	36-37	5	30-31	1	113-117	3
49-50	15	34-35	4	28-29	5	108-112	5
47-48	13	32-33	4	26-27	6	103-107	5
45-46	12	30-31	3	24-25	3	98-102	3
43-44	10	28-29	4	22-23	4	93-97	9
41-42	6	26-27	2	20-21	2	88-92	4
39-40	4	24-25	11	18-19	2	83-87	7
37-38	3	22-23	7	16-17	10	78-82	7
35-36	5	20-21	9	14-15	5	73-77	8
33-34	1	18-19	8	12-13	11	68-72	9
31-32	2	16-17	4	10-11	13	63-67	10
29-30	1	14-15	5	8-9	12	58-62	7
27-28	2	12-13	6	6-7	18	53-57	7
25-26	2	10-11	10	4-5	11	48-52	3
		8-9	5	2-3	4	43-47	4
		6-7	9	0-1	3	38-42	3
		4-5	5			33-37	2
		2-3	3			28-32	1
		0-1	8				

	First Group	Second Group	Detroit Word Recognition	Composite
Number of cases	116	116	116	103
Highest possible score	57	50	40	147
Mean score	47.04	18.48	14.00	78.75
Standard deviation	7.10	9.62	8.88	23.15

AN INDIVIDUAL MEASURE OF READING ABILITY ³

Among other things, it was hoped that the tests of reading readiness described in Chapter III would make it possible to select those pupils at the beginning of the term who would fail in reading during the first semester. In order to secure a more accurate measure of the reading ability of the pupils who were near the line between failure and passing, thirty-three pupils who made the lowest scores on the first group test of reading ability were tested individually. The individual reading test consisted of two passages; one passage was composed of forty-three words divided into seven sentences, and the other was made up of sixty-six words divided into ten sentences. There were three comprehension questions based upon each passage.¹ The first selection was an exact reproduction of a passage in the text. The second selection contained words that had been studied just as thoroughly as those in the first, but they were made into a story which did not appear in the text. A record of the child's responses was kept by drawing a line through those words which he did not know and would not attempt to pronounce, encircling the words he omitted, drawing a short line through each letter of a word mispronounced, and inserting any words that he substituted. The time required to read each selection and the responses to the comprehension questions were also recorded.

Reading efficiency appeared to be quite different in the two selections. In the selection copied from the text only 10 per cent of the total number of responses made by the 33 pupils in pronouncing the words were wrong, while 24 per cent of the responses made in reading the selection composed from familiar words were wrong. Taking the number of sentences read without error as the score, the difference is even more striking. Of the sentences in the first selection, 77 per cent were read without error, while in the last passage only 33 per cent of the sentences were correctly read. Only one child out of the 33 who took the test missed a single comprehension question on the first passage (in fact, it appeared to the examiner that they could have answered the questions without reading the passage at all), while 24 pupils missed comprehension questions on the last passage. This evidence indicates that the 33 children who made the lowest scores on the first group test of reading ability had learned to pro-

³ See Appendix for this test.

nounce certain words which they had studied intensively without understanding the meaning of sentences made up of these words.

The best method of scoring the individual test of reading ability, determined by correlating the scores on it with the scores of the 33 pupils on the first group test of reading ability, was: the number of words correctly pronounced plus ten times the number of comprehension questions correctly answered. Table 5 shows that the correlation between the individual test and a composite of the test given at the end of the thirteenth week, the test given at the end of the eighteenth week, and the Detroit Word Recognition Test is .80. The individual test correlates with the first group reading test .71, with the second group reading test .50, and with the Detroit Word Recognition Test .60. In view of the narrow range of reading ability represented by the 33 pupils who took the individual test, these correlations are satisfactory.

SECOND GROUP TEST OF READING ABILITY ⁴

In this test an attempt was made to measure the pupils' ability to comprehend complete sentences. After a consideration of several methods that might be used to indicate whether the child comprehended what he had read, it was decided to have the child make a mark through the sentences that were not true to fact and to do nothing to those sentences that were true. The test contained 29 true statements and 31 false statements. The false statements were made so absurd that any one who could read and comprehend them would know that they were false. This was done in order to reduce to a minimum the amount of intelligence, as distinguished from reading ability, required to succeed with the sentences. The directions ⁵ for giving the test describe how the procedure was explained to the child.

At the time that this test was given the slowest-moving section had studied 136 different words, 87 of which belonged in the group that was to be thoroughly mastered. The test contained 82 words that had been studied, 55 of which belonged in the group to be thoroughly learned. The third, sixth, and ninth columns of Table 3 show which words, among those to be thoroughly learned, were included in the second group test of

⁴ See Appendix for this test.

⁵ See Appendix for the directions.

reading ability by indicating the frequency with which they occurred in the test. A frequency of zero means that the word did not occur in the test.

Thirty words which were not in the material studied during the semester were included in the test in order to make adequate provision for the superior pupils. These words are as follows:

am	feet	it	now	three
baby	four	lay	over	two
ball	fly	like	play	warm
bird	green	likes	school	winter
egg	ground	mouth	sing	with
eyes	has	nest	snow	when

The second group test of reading ability was given during the eighteenth week after the beginning of the semester. The testing conditions, such as time allowed, size of the groups tested, and number of persons administering the test, were the same as those described in connection with the first group test of reading ability. The score was determined by subtracting the number of exercises wrong from the number correct.

The frequency distribution of the scores on the test is given in Table 4. With the exception of the eight scores at the lowest interval, the distribution is fairly normal. The table shows that the highest score obtained is 43, that the mean score is 18.48, and that the standard deviation is 9.62. The highest possible score is .50. The reliability of the test, determined by correlating the scores on random halves and then applying the Spearman-Brown formula, is $.75 \pm .02$ for 129 cases.

As shown in Table 5, this test correlates .50 with the individual test of reading ability and .74 with the first group test of reading ability. The correlation of .50 is low, but since there were only 33 cases involved in the individual reading test, and since those taking the individual test represent a narrow range of reading ability, it is probably less significant than the correlation of .74 with the first group reading test where the correlation is based upon 116 cases. The average correlation of this test with teachers' ratings is .67.

THE DETROIT WORD RECOGNITION TEST

The day following the administration of the second group test of reading ability, the Detroit Word Recognition Test was given.

TABLE 5
CORRELATIONS OF THE VARIOUS READING TESTS WITH ONE ANOTHER, WITH TEACHERS' RATINGS, AND WITH THE PINTNER-CUNNINGHAM TEST OF MENTAL ABILITY

	INDIVIDUAL READING TEST	FIRST GROUP READING TEST	FIRST GROUP PLUS SECOND GROUP READING TEST	TEACHERS' RATINGS					PINTNER- CUNNING- HAM MENTAL TEST	SECOND GROUP READING TEST
				Section 1	Section 2	Section 3	Section 4	Average for Ratings		
Composite of Three Group Reading Tests.	.80 ± .04 32 cases			.79 ± .04 38 cases	.69 ± .08 19 cases	.87 ± .02 35 cases	.68 ± .06 36 cases	.76	.68 ± .03 103 cases	
First Group Reading Test	.71 ± .06 33 cases			.43 ± .09 38 cases	.69 ± .08 20 cases	.71 ± .05 41 cases	.45 ± .08 41 cases	.57	.54 ± .05 103 cases	
Second Group Reading Test	.50 ± .09 33 cases	.74 ± .03 116 cases		.67 ± .06 38 cases	.69 ± .07 26 cases	.71 ± .05 41 cases	.63 ± .06 40 cases	.67	.57 ± .04 103 cases	
Detroit Word Recogni- tion Test	.60 ± .08 33 cases	.62 ± .04 116 cases	.74 ± .03 116 cases	.56 ± .07 38 cases	.62 ± .08 25 cases	.81 ± .04 41 cases	.40 ± .09 39 cases	.60	.75 ± .03 103 cases	.67 ± .03 130 cases
Detroit Plus Second Group Reading Test..		.69 ± .03 116 — .03								

All correlations in this study were calculated by the Pearson product-moment method.

Form A of this test was selected as the best standardized test for the purpose because it contained more words than any other standardized test examined. Instead of the time being limited to four minutes as provided in the directions for giving the test, the pupils were allowed sufficient time to do all the exercises they could. With this exception all other directions accompanying the test were followed.

The frequency distribution of the scores on this test is given in Table 4. The highest score obtained is 37, the mean score is 14, and the standard deviation is 8.88. The highest possible score is 40. The reliability of the test, as reported in the manual of directions, is approximately .92. The test was difficult for the group as a whole, due to the fact that it contained so many words that had not been studied.

Table 5 shows that the correlation of the Detroit Word Recognition Test with the individual test of reading ability is .60, with the first group test of reading ability .62, with the second group test of reading ability .67, and with the combined scores on the first and second group reading test .74. The average correlation with the teachers' ratings is .60.

The last two columns of Table 4 give the frequency distribution of the total scores on the test given at the end of the thirteenth week, the test given at the end of the eighteenth week, and the Detroit Word Recognition Test. The total scores were obtained by adding the scores on the three tests without any correction for the difference in the standard deviations because what differences there were weighted the tests in the way that inspection indicates they should be weighted. The second group test of reading ability with a standard deviation of 9.62 receives the most weight. It seems reasonable that this test should receive the greatest weight because, in order to succeed with it, the pupil had to read complete sentences and comprehend the meaning of them. The Detroit Word Recognition Test, with a standard deviation of 8.88, ranks next in amount of weight received. Twenty-six of the forty items in the Detroit test involve reading and understanding phrases. In many instances the phrases contained one or more words that the pupils had not studied in their school work. It seems reasonable, therefore, that this test should receive more weight than the first group test of reading ability (standard deviation 7.10), most of which was a test of

word recognition and word recall. The reliability of the combined tests of reading ability already described, determined by correlating random halves and then applying the Spearman-Brown formula, is .93 for 151 cases. The composite score on the three group tests is, without doubt, the best single measure of the reading ability of this group of pupils.

TEACHERS' RATING OF READING ABILITY

During the seventeenth week of the semester the four teachers who were teaching this group of children were asked to rate⁶ their pupils for general reading ability on a scale of fifteen points. The teachers were given two sheets of paper, each of which had been marked off into fifteen rectangles that were numbered consecutively from 1 to 15. One sheet contained the names of forty-one pupils distributed among the rectangles according to their reading ability. This sheet served as an example of what the teachers were asked to do. The other sheet of paper contained the numbered rectangles and the following directions:

Let 1 be the score of your poorest reader (or readers), let 15 be the score of your best reader (or readers), and let 8 be the score of your average readers. Write each child's name in the rectangle the number of which, you think, best represents his rank in reading ability in your class. In general, more pupils' scores fall at the middle (scores 5, 6, 7, 8, and 9) than fall at the extremes (scores 1 and 2 or 14 and 15) of the scale. However, this may not be true with your group. The accompanying sheet shows how one teacher rated her class of forty-one pupils.

Table 5 shows the correlation between teachers' ratings and the total scores on the three group tests of reading ability for each of the four sections of the first grade. The correlation of .79 for section 1 and the correlation of .87 for section 3 are higher than most correlations between teachers' ratings and objective measures of the same traits. The same pupils attended these sections throughout the semester. In sections 2 and 4 where the correlations between teachers' ratings and the composite score of the three group tests of reading ability are .69 and .68, respectively, there was considerable change in pupil personnel during the semester. Section 2 received the late entrants who could not speak English and those who were decidedly low in mental ability. Section 4 received all other late entrants. This

⁶ The ratings were made before the teachers had any knowledge of the pupils' scores on the reading tests.

fact may account for some of the differences between the correlations of teachers' ratings with reading scores for the four sections. However, the correlations on the whole are very satisfactory.

The writer believes that the data presented in this chapter show that, when tests are properly constructed from the vocabulary which the pupils have been studying, the first semester of first-grade reading achievement can be measured by standardized tests; at present, the ratings of teachers and supervisors are depended upon for measures of reading ability in beginning reading. No claim is made, however, that the tests described in this study are standardized. The standardization of a reading test is not within the scope of this study.

CHAPTER V

THE RESULTS

After an acceptable measure of reading achievement was established, the next step was to find the relation between the pupils' reading ability, as measured by their composite score on the three reading tests, and their scores on the tests given for the purpose of studying reading readiness. Table 6 shows the intercorrelations between the different variables and the correlation of each variable with the criterion (composite score on the three group tests of reading ability).

TABLE 6
INTERCORRELATIONS OF THE FIVE VARIABLES AND THE CORRELATION OF EACH
VARIABLE WITH THE CRITERION—COMPOSITE OF THE THREE GROUP
TESTS OF READING ABILITY

	Pintner- Cunning- ham Test	Visual- Visual Association Test	Word Selection Test	Visual- Auditory Association Test	Content Compre- hension and Recall Test
Composite Score on 3 Reading Tests	.70	.52	.49	.39	.37
Pintner- Cunningham Test		.51	.53	.36	.36
Visual-Visual Association Test			.35	.41	.21
Word Selection Test				.28	.21
Visual- Auditory Association Test					.26

All correlations in this table are based upon 103 cases.

In this study we are especially interested in the correlations between the scores on the four individual tests ¹ designed to study

¹ The visual-visual association test, the word selection test, the visual-auditory association test, and the content comprehension and recall test which were described in Chapter III.

reading readiness and the reading achievement scores. For this reason we shall leave the correlation of .70 between the test of mental ability and the composite scores on the three tests of reading achievement for later discussion.

The multiple correlation gives the relation between the scores actually made on the reading tests and the reading scores predicted from the tests used to study reading readiness. The test of visual-visual association is used as the basic test because the correlation of .52 between it and reading achievement is the highest of the four correlations between the individual tests of reading readiness and reading achievement. When the scores on the test of word selection are properly weighted and combined with the scores on the test of visual-visual association the correlation is raised to approximately .62 (.61522 to be exact). The test of visual-auditory association raises the correlation to .63 (.631585). When the scores on the test of content comprehension and recall are added the correlation is increased to .66 (.661815). This correlation is only four points less than the correlation of .70 between the mental test and reading achievement. Hence, we have constructed a test which correlates almost as highly with reading achievement as a standardized test of mental ability. When the mental test is combined with the four individual tests of reading readiness, the correlation with reading achievement is raised to approximately .75 (.747663). Thus the mental test raises the correlation between the individual tests of reading readiness and reading achievement 8 points.

In view of the fact that the test of mental ability correlates higher with reading achievement than any of the other tests of reading readiness studied, it is the one which should be used as a basic test to find out what each individual test of reading readiness contributes to the multiple correlation between the tests of reading readiness and reading achievement. The correlation of .70 is raised to approximately .73 (.725120) when the test of visual-visual association is added to the mental test. The test of word selection increases the correlation to about .74 (.737631). The test of visual-auditory association raises the correlation to .74 (.742765), and the test of content comprehension and recall increases the correlation to .75 (.750266). That is, the correlation between the reading scores predicted from the five tests of reading readiness (test of mental ability and the four individual tests

of reading readiness) and the actual reading scores is approximately .75.

The multiple correlation of .750266 obtained when the mental test is used as the basic test theoretically should be identical with the multiple correlation of .747663 obtained when the test of visual-visual association is used as the basic test. This slight difference is due to the fact that only four decimal places were used in making most of the calculations.

At this point the following question merits consideration: To what extent is the increase in correlation from .70, between reading achievement and the mental test, to .75, between reading achievement and a combination of the mental test and the four individual tests of reading readiness, due to the fact that the combination of the mental test and the four individual tests of reading readiness measures mental ability more reliably than the mental test alone? In other words, would the correlation of .70 have been raised to .75 if two forms of the mental test had been given and correlated with reading achievement?

The following data are available concerning the mental test and the combined tests of reading achievement: The average coefficient of reliability for the mental test as reported on page 3 of the manual of directions for the Pintner-Cunningham Primary Mental Test is .905. The coefficient of reliability for the three group tests of reading achievement (the first group test of reading achievement given during the thirteenth week of the semester, and the second group test of reading achievement together with the Detroit Word Recognition Test given during the eighteenth week of the semester), found by correlating random halves of the three tests treated as one, and then applying the Spearman-Brown formula, is .93. The correlation between the total scores on the three group tests of reading achievement with the mental test is .70.

The formula for correcting the r between two tests for attenuation (chance errors in measurement) when the correlation between only one form of each test is known is as follows: ²

$$r_{AB} = \frac{r_{A_1B_1}}{\sqrt{r_{A_1A_2} r_{B_1B_2}}}.$$

² For this formula see Henry E. Garrett, *Statistics in Psychology and Education*, p. 213. New York: Longmans, Green and Co., 1926.

In the formula, $r_{A_1B_1}$ represents the correlation between reading achievement and mental ability, $r_{A_1A_2}$ represents the reliability coefficient of the test of reading achievement, $r_{B_1B_2}$ represents the coefficient of reliability of the mental test, and r_{AB} stands for the correlation between reading achievement and mental ability corrected for attenuation.

Substituting the values given above in the formula, we have:

$$r_{AB} = \frac{.70}{\sqrt{(.93)(.90)}}$$

and solving the equation we get: $r_{AB} = .77$.

Thus, the correlation between the combined tests of reading achievement and the scores on the mental test corrected for attenuation is .77. But the point in question is: What correlation between the combined tests of reading achievement and the mental test ($r_{A_1B_1}$) could be expected after increasing the reliability of the mental test ($r_{B_1B_2}$) by giving two forms instead of one?

By the use of the Spearman-Brown formula it was found that two forms of the Pintner-Cunningham Mental Test correlate .94 with two other forms. We now have the following values for the terms in the formula: $r_{AB} = .77$; $r_{A_1A_2} = .93$; $r_{B_1B_2} = .94$; to find: $r_{A_1B_1}$.

Substituting the above values in the original formula, we have:

$$.77 = \frac{r_{A_1B_1}}{\sqrt{(.93)(.94)}}$$

and solving,³ we find that: $r_{A_1B_1} = .7161$.

Hence the correlation of .70 between reading achievement and the Pintner-Cunningham Mental Test would be raised to only .7161 when two forms of the Pintner-Cunningham Mental Test are used. Thus, the increase from .70, between reading achievement and the mental test, to .75, between reading achievement and the mental test combined with the individual tests of reading readiness, is, in all probability, not due to the fact that the combination of the Pintner-Cunningham Mental Test and the individual tests of reading readiness measures mental ability more reliably than the Pintner-Cunningham alone. Consequently,

³ This use of the attenuation formula is illustrated in a syllabus used by Professor W. A. McCall in his class in statistics at Teachers College, Columbia University, during the year 1925-26.

the individual tests of reading readiness measure, to a certain extent, mental traits different from those measured by the Pintner-Cunningham Mental Test.

By means of partial correlation it is possible to determine the correlation between reading achievement and the individual tests of reading readiness, with ability on the mental test held constant; that is, its influence eliminated from the correlation. This correlation, which is .38, constitutes further evidence that the individual tests of reading readiness measure traits that are somewhat different from those measured by the Pintner-Cunningham Mental Test.

The regression equation shows the weights to be attached to a pupil's score in each of the tests of reading readiness in order to predict his score in reading achievement. The regression equation is as follows ⁴: $X_1 = 1.21 X_2 + 1.9 X_3 + .58 X_4 + .43 X_5 + .42 X_6 + 12.09$. In the equation X_1 stands for the score in reading achievement that is to be predicted; X_2 stands for the score in the Pintner-Cunningham Mental Test; X_3 , the score in the test of visual-visual association; X_4 , the score in word selection; X_5 , the score in visual-auditory association; and X_6 the score in content comprehension and recall. The 12.09 is a constant which is added in the case of each pupil's score. By using this formula it is possible to determine the weighted score (criterion score) for any child for whom the scores on the Pintner-Cunningham Mental Test and the other four tests of reading readiness have been obtained. For example, pupil number 10 in Table 8 has a score of 37 in the mental test, 15 in the visual-visual association test, 23 in the test of word selection, 11 in the test of visual-auditory association, and 22 in the test of content comprehension and recall.

Substituting in the above formula, the pupil's final weighted score would be computed as follows:

$$\begin{aligned} X_1 &= 1.2(37) + 1.9(15) + .58(23) + .43(11) + .42(22) + 12.09 \\ X_1 &= 44.77 + 28.5 + 13.34 + 4.73 + 9.24 + 12.09 \\ X_1 &= 112.67 \text{ weighted score.} \end{aligned}$$

Multiplying the scores by such numbers as 1.21, 1.9, .58, and so on, is too cumbersome. Hence each of the weights in the

⁴ See Henry E. Garrett, *Statistics in Psychology and Education*, Chapter V, "Partial and Multiple Correlation."

preceding formula was divided by $1\frac{1}{4}$ to give the weights used in the following formula:

$$X_1 = X_2 + 1\frac{1}{2}X_3 + \frac{1}{2}X_4 + \frac{1}{3}X_5 + \frac{1}{3}X_6 + 10.00.$$

In order to compute the weighted score of pupil number 10 in Table 8, we substitute his scores and multiply the result by $1\frac{1}{4}$:

$$\begin{aligned} X_1 &= 1(37) + 1\frac{1}{2}(15) + \frac{1}{2}(23) + \frac{1}{3}(11) + \frac{1}{3}(22) + 10.00 \\ X_1 &= 92. \qquad 92 \times 1\frac{1}{4} = 115. \end{aligned}$$

This gives 115 instead of 112.67, the amount obtained by using the more cumbersome weights. The agreement between the two scores is close enough for practical purposes and the calculations are much easier to make by the latter method. The actual reading score of pupil number 10 as shown by Table 8 is 113.

In order to know what the predicted score would be for any given set of weighted scores, a diagram was constructed by plotting the weighted scores, calculated as explained above, against the actual reading scores and drawing the line⁵ which best represents the relation between the two sets of scores. Table 7 gives a list of the scores thus obtained.

In order to determine how the formula works out in practice, the mental test score and the scores on the four individual tests of reading readiness for each pupil were combined into a final weighted score and then converted into a probable reading score by means of Table 7. The correlation between the most probable reading scores and the actual reading scores was $.746 \pm .03$. This correlation agrees very closely with the multiple correlation of .75 which, as explained before, is defined as the correlation between the reading scores predicted from the tests of reading readiness and the actual reading scores. This means that at the beginning of the semester the reading achievement of this group of pupils could have been predicted to the extent that is represented by a correlation of .75.

Table 8 shows the scores on the mental test, the four individual tests of reading readiness, the weighted scores, the actual reading scores, the predicted reading scores, and the difference between the actual and the predicted reading scores for the 103 pupils for whom the data were complete. The scores are entered in the table according to the descending order of the actual reading scores.

⁵ See Arthur S. Otis, *Statistical Method in Education*, pp. 101-108. World Book Company, 1925.

TABLE 7
WEIGHTED SCORES AND THE MOST PROBABLE FINAL READING SCORES

WEIGHTED SCORE	PROBABLE FINAL READING SCORE	WEIGHTED SCORE	PROBABLE FINAL READING SCORE
20	26	71	78
21	27	72	79
22	28	73	81
23	29	74	82
24	30	75	83
25	31	76	84
26	32	77	85
27	33	78	86
28	34	79	87
29	35	80	88
30	36	81	89
31	37	82	90
32	38	83	91
33	39	84	92
34	40	85	93
35	42	86	94
36	43	87	95
37	44	88	96
38	45	89	97
39	46	90	98
40	47	91	99
41	48	92	100
42	49	93	101
43	50	94	102
44	51	95	103
45	52	96	104
46	53	97	105
47	54	98	106
48	55	99	107
49	56	100	108
50	57	101	109
51	58	102	110
52	59	103	111
53	60	104	112
54	61	105	113
55	62	106	114
56	63	107	115
57	64	108	116
58	65	109	117
59	66	110	118
60	67	111	119
61	68	112	120
62	69	113	121
63	70	114	123
64	71	115	124
65	72	116	125
66	73	117	126
67	74	118	127
68	75	119	128
69	76	120	129
70	77		

TABLE 8

SCORES ON TESTS OF READING READINESS, WEIGHTED SCORES, ACTUAL FINAL READING SCORES, PREDICTED READING SCORES, AND THE DIFFERENCE BETWEEN PREDICTED AND FINAL READING SCORES FOR 103 PUPILS

PUPIL No.	PINT-NER-CUNNINGHAM TEST	VISUAL-VISUAL ASSOCIATION TEST	TEST OF WORD SELECTION	VISUAL-AUDITORY ASSOCIATION TEST	CONTENT-COMPREHENSION AND RECALL TEST	WEIGHTED SCORE	ACTUAL FINAL READING SCORE	PREDICTED READING SCORE	DIFF. BETWEEN PREDICTED AND ACTUAL READING SCORES
1	26	7	20	13	18	84	130	92	+38
2	31	9	31	13	24	103	125	111	+14
3	33	10	22	19	22	103	121	111	+10
4	31	15	20	16	14	105	120	113	+7
5	35	9	25	12	14	100	120	108	+12
6	34	6	14	11	5	83	119	91	+28
7	31	12	19	19	16	99	116	107	+9
8	27	7	23	15	21	89	115	97	+18
9	25	5	24	17	15	83	115	91	+24
10	37	15	23	11	22	115	113	124	-11
11	28	5	20	20	21	88	110	96	+14
12	19	8	17	15	16	74	109	82	+27
13	28	5	24	4	19	81	108	89	+19
14	42	8	31	15	26	116	108	125	-17
15	24	7	22	13	19	83	108	91	+17
16	30	5	23	15	18	88	107	96	+11
17	17	5	11	18	15	64	105	71	+34
18	18	9	15	10	9	69	104	76	+28
19	23	4	24	16	20	79	104	87	+17
20	30	8	23	15	14	91	103	99	+4
21	30	7	22	14	22	93	101	101	0
22	37	5	19	15	20	95	101	103	-2
23	27	2	20	15	10	73	97	81	+16
24	23	5	23	16	10	75	96	83	+13
25	12	5	20	19	20	66	96	73	+23
26	24	3	20	11	19	74	95	82	+13
27	16	1	12	11	26	59	95	66	+29
28	25	8	13	13	14	78	94	86	+8
29	22	10	22	17	22	89	94	97	-3
30	27	7	20	6	13	80	93	88	+5
31	29	12	20	11	13	94	93	102	-9
32	27	5	22	8	14	80	90	88	+2
33	16	7	14	12	23	70	89	77	+12
34	13	5	27	10	18	66	89	73	+16
35	23	6	13	15	24	76	88	84	+4
36	25	9	18	15	14	85	87	93	-6
37	14	11	18	19	9	74	87	82	+5
38	20	4	21	12	18	70	85	77	+8
39	25	4	25	13	15	78	84	86	-2
40	20	6	25	11	4	70	84	77	+7

TABLE 8—(Continued)

PUPIL No.	PINT- NER- CUN- NING- HAM TEST	VISUAL- ASSOCI- ATION TEST	TEST OF WORD SELEC- TION	VISUAL- AUDI- TORY ASSOCI- ATION TEST	CONTENT COMPRE- HENSION AND RECALL TEST	WEIGHT- ED SCORE	ACTUAL FINAL READ- ING SCORE	PREDI- CTED READ- ING SCORE	DIFF. BE- TWEEN PRE- DICTED AND ACTUAL READ- ING SCORES
41	15	5	13	19	1	56	84	63	+21
42	21	7	14	8	13	70	83	77	+ 6
43	14	4	5	12	5	48	83	55	+28
44	22	2	16	13	21	68	82	75	+ 7
45	19	5	24	19	19	76	81	84	- 3
46	23	6	26	16	18	83	81	91	-10
47	35	5	22	13	10	89	81	97	-16
48	20	4	9	5	10	56	80	63	+17
49	15	6	24	14	15	70	80	77	+ 3
50	15	4	11	13	5	53	78	60	+18
51	26	6	10	11	24	78	77	86	- 9
52	12	6	21	11	1	56	77	63	+14
53	18	3	18	8	15	63	76	70	+ 6
54	19	2	20	9	8	60	76	67	+ 9
55	17	8	13	12	10	65	75	72	+ 3
56	12	8	17	11	16	64	74	71	+ 3
57	16	5	16	14	13	64	73	71	+ 2
58	13	2	12	13	19	53	72	60	+12
59	14	2	12	11	17	54	72	61	+11
60	15	2	16	9	13	54	71	61	+10
61	16	6	17	20	12	68	70	75	- 5
62	14	2	17	5	11	50	70	57	+13
63	8	1	5	10	24	41	70	48	+22
64	10	0	13	2	5	36	69	43	+26
65	13	1	12	8	19	50	69	57	+12
66	20	4	14	15	10	64	68	71	- 3
67	17	10	17	13	20	76	67	84	-17
68	16	6	15	14	10	63	67	70	- 3
69	13	5	11	10	12	54	67	61	+ 6
70	19	2	8	5	18	55	66	62	+ 4
71	18	8	20	15	19	76	66	84	-18
72	10	3	21	6	21	55	65	62	+ 3
73	17	7	18	9	11	68	65	75	-10
74	15	3	5	12	21	54	65	61	+ 4
75	13	4	22	5	16	59	64	66	- 2
76	9	7	21	12	16	61	63	68	- 5
77	17	2	14	14	5	55	61	62	- 1
78	15	5	9	9	15	56	60	63	- 3
79	24	6	23	15	7	76	59	84	-25
80	12	0	19	6	0	41	59	48	+11
81	17	5	11	5	5	55	59	62	- 3
82	21	5	21	10	12	70	58	77	-19
83	19	9	22	8	17	79	58	87	-29

TABLE 8—(Continued)

PUPIL No.	PINTER-CUNNINGHAM TEST	VISUAL-VISUAL ASSOCIATION TEST	TEST OF WORD SELECTION	VISUAL-AUDITORY ASSOCIATION TEST	CONTENT COMPREHENSION AND RECALL TEST	WEIGHTED SCORE	ACTUAL FINAL READING SCORE	PREDICTED READING SCORE	DIFF. BETWEEN PREDICTED AND ACTUAL READING SCORES
84	16	0	17	7	14	51	56	58	- 2
85	15	8	10	13	3	59	55	66	-11
86	21	6	4	9	24	67	55	60	- 5
87	19	8	18	19	21	79	54	87	-33
88	7	1	16	14	14	46	53	53	0
89	14	2	11	9	18	51	53	58	- 5
90	20	8	10	11	16	70	53	77	-24
91	21	0	21	15	12	63	51	70	-19
92	15	0	9	8	10	44	50	51	- 1
93	0	5	16	9	0	36	49	43	+ 6
94	16	3	14	6	10	54	46	61	-15
95	21	3	10	16	13	63	46	70	-24
96	16	4	18	15	18	65	43	72	-29
97	8	2	15	8	10	43	43	50	- 7
98	5	0	4	13	11	31	42	37	+ 5
99	0	0	10	5	10	25	42	31	+11
100	19	6	20	16	8	70	38	77	-39
101	19	2	19	2	4	54	35	61	-26
102	0	0	10	1	3	20	34	26	+ 8
103	10	7	6	9	9	50	31	57	-26

Table 9 gives the data pertaining to the reading status of those children who, according to criteria to be explained later, had not learned to read. The fifth column of the table gives the scores made by those pupils who took the individual test of reading ability. This test, as mentioned before, was given to the 33 pupils who made low scores on the first group test of reading ability. It consists of two passages,⁶ one of which was a reproduction of a selection in the text and the other was constructed from words that the pupils had studied thoroughly. Any pupil whose score was less than 82 on the individual test failed to read without error as many as one-half of the sentences in the passage composed from familiar words. Any pupil whose score was 82 or less on the individual reading test was considered as failing in reading in so far as that test measured his reading ability. The next column gives the teachers' ratings. The pupils were rated

⁶ See Appendix for this test.

for general reading ability on a scale of 15 points, 1 being the lowest rating. The letter "F" accompanying a rating means that the child was not going to be promoted; the question mark accompanies the ratings of those pupils whose promotion was doubtful; and the asterisk indicates that the pupil belonged in the lowest of the four sections in regard to mental rating. A pupil in the lowest section may have a rating of 7 or 8 and yet fail to learn to read.

TABLE 9

SCORES ON THREE GROUP TESTS OF READING ABILITY AND INDIVIDUAL READING TEST, TEACHERS' RATING OF READING ABILITY, AND WEIGHTED SCORES FOR PUPILS DOING FAILING OR QUESTIONABLE WORK IN READING

PUPIL	FIRST GROUP READING TEST (Lowest 20% have score of 42 or below)	SECOND GROUP READING TEST (Lowest 20% have score of 8 or below)	DETROIT READING TEST (Lowest 20% have score of 6 or below)	INDIVIDUAL READING TEST	TEACHERS' RATING †	WEIGHTED SCORES
77 ..	36	20	5	66	5	55
79 ..	42	10	7	78	1	76
81 ..	36	12	11	80	4	55
82 ..	42	6	10	79	4	70
83 ..	44	8	6	..	6	79
84 ..	49	0	7	..	3	51
85 ..	45	4	6	..	1F	59
87 ..	34	8	12	82	3	79
88 ..	39	8	6	67	2?	46
89 ..	48	2	3	..	4	51
90 ..	43	0	10	..	2?	70
91 ..	39	8	4	47	1F	63
92 ..	38	8	4	60	1F	44
93 ..	38	6	5	60	4*	36
94 ..	42	0	4	33	1F	54
95 ..	31	10	5	42	1F	63
96 ..	41	0	2	72	2?	65
97 ..	36	6	1	..	..	43
98 ..	38	0	4	69	8*	31
99 ..	35	4	3	58	7*	25
100 ..	25	6	7	41	2?	70
101 ..	30	2	3	39	1F	54
102 ..	28	6	0	3	..	20
103 ..	26	0	5	26	1F	50

† Teachers' rating of reading ability is explained on page 28. Number 1 is the lowest rating given and number 15 is the highest rating.

If a pupil's score is among the twenty low scores on as many as two of the group tests of reading ability and also falls below

82 on the individual reading test, or has been marked as failing or doubtful by the teacher, this pupil was considered as having failed to learn to read. There are four cases, pupils 83, 84, 89, and 97, that have neither the failing mark of the teacher nor the low individual test score to confirm their low reading ability as indicated by their low scores in the group reading tests, but these were included in the table after a conference with the teacher revealed the fact that their reading ability was no better than some of those already included in the table. The numbers in Table 9 represent the same pupils as those in Table 8. A comparison of the two tables shows that the pupils who were regarded as failing in first semester reading includes all the pupils, except three, from number 76 to and including number 103. The three pupils not included had individual reading scores or teachers' ratings which showed that they were not failing in reading according to our criteria.

The column headed "actual final reading score" in Table 8 gives the total reading scores on the three group tests of reading ability. An examination of the reading scores of the 24 pupils failing in reading reveals that the highest score made on the three group tests combined was 61. Table 7 shows that the weighted score corresponding to a reading score of 62 is 55. Thus a weighted score of approximately 56 seems necessary to insure success in the first semester of reading. The last column in Table 9 shows the weighted scores of the pupils who failed in first-semester reading according to our criteria. The average weighted score of the 24 pupils is 55. There are six scores which are more than 10 points above the presumably necessary 56 points of weighted score. There seems to be considerable discrepancy between the weighted scores and the reading scores in these six cases. In answer to inquiry concerning the reading progress of pupil number 100, the teacher said that during the first two weeks of school this pupil progressed as rapidly as any one in his class, but after the second week there seemed to be a sudden change in his progress and after that time reading had been very difficult for him. His I.Q. according to the Pintner-Cunningham Mental Test is 92. The I.Q.'s of the section of which this pupil was a member ranged from 57 to 100, with the majority falling in the 90's. Pupil number 83, whose weighted score is 79, has the same mental score and the same I.Q. as pupil number 100.

The teacher of pupil 83 volunteered the information that he was one of the most annoying children in her section from the point of view of doing things that are not permitted in the schoolroom. No information that would account for the discrepancies in the other four cases came to the attention of the writer. The attendance records were examined but no excessive absences were found among the six pupils.

TABLE 10

PER CENT OF CHILDREN WHO DID OR DID NOT EXCEED A READING SCORE OF 62 AS PREDICTED

<i>Weighted Scores</i>	<i>Per Cent Below</i>
0-35	100
0-47	80
0-53	61
0-55	54
	<i>Per Cent Above</i>
53- 60	75
56- 70	73
56- 80	77
56- 90	81
56-100	83
56-101 and above.....	84

Table 10 shows the extent to which weighted scores predict success and lack of success in reading. Eighty per cent of the children making weighted scores of 47 or less failed in reading, according to criteria discussed above. Seventy-five per cent of those making weighted scores of 56 or above succeeded in the first semester of reading. This indicates that the tests predict success in reading accurately enough to be useful in work with beginning readers.

CHAPTER VI

SUMMARY AND CONCLUSIONS

1. This experiment was conducted to develop a means for predicting first-grade reading achievement at the time pupils enter the first grade.

2. Data for the study came from practically all the pupils who entered the first grade of a New York City public school in February, 1929.

3. The tests which were used to predict reading achievement were given during the first four weeks of the semester and were as follows:

The Pintner-Cunningham Primary Mental Test.

A test of visual-visual association.

A test of word selection.

A test of visual-auditory association.

A test of content comprehension and recall.

4. Data for all those pupils who entered school after the first three weeks, those who did not speak English, and those who were repeating the first semester of reading do not enter into the calculations except for determining the reliability of two of the tests.

5. An examination of several well-known standardized tests designed to measure first-grade reading achievement revealed the fact that the tests employed widely different vocabularies and that none of them contained enough words which this group of children had studied to measure their reading achievement.

6. Reading achievement was measured at two different times, once during the thirteenth week, and again during the eighteenth week of the semester.

7. The measures of reading achievement consisted of three group tests of reading ability and ratings by the teachers. Two of the group reading tests were constructed especially for this experiment from the vocabulary which the pupils had studied. The third reading test used was the Detroit Word Recognition

Test. The correlations of the scores on the two group tests of reading ability constructed especially for this experiment with the scores on the Detroit Word Recognition Test and with teachers' ratings justify the conclusion that first-semester reading achievement can be measured objectively. Instead we have depended almost entirely upon the ratings of teachers and supervisors for measures of progress in reading in the first semester. The types of exercises used in the two tests of reading ability constructed for this study furnish a technique by which reading tests can be constructed from any vocabulary used in beginning reading.

8. The correlations found between the five tests of reading readiness and the combined scores on the tests of reading ability show that the Pintner-Cunningham Mental Test gives the best single means of predicting first-grade reading achievement. However, the other tests used in this study raised the predictive power of the mental test appreciably. The combined scores on the individual tests of reading readiness correlate with reading achievement practically as well as the scores on the standardized mental test.

9. When a pupil's scores on the five tests of reading readiness are combined according to the following formula they give the best predictive measure of his ability to learn to read:

$$\begin{aligned} \text{Predicted reading score} = & \text{mental test score} + \\ & \frac{\text{visual-visual association}}{2} + \frac{\text{word selection}}{2} + \\ & \frac{\text{visual-auditory association}}{3} + \frac{\text{content comprehension and recall}}{3} + 10. \end{aligned}$$

By using the above formula it is possible to obtain weighted scores by which, in a large percentage of the cases, one may select those children who are likely to have difficulty in reading.

10. There is a group of factors, such as, interest in stories, pictures, things, people, and surrounding life, the number of stories read or known, the extent to which conversation is carried on with others—that is, the child's proneness to things verbal in general—which, no doubt, are significant in a study of reading readiness, but a thorough and objective study of all these factors would constitute an investigation in itself.

This investigation has shown the possibility of predicting first-grade reading achievement to an extent which justifies its use

in beginning reading. Future studies along this line will, in all probability, make more accurate prediction possible, but there will always be a group of factors, such as health, attitude toward school work, personality traits, teaching procedures, and the like, which will lower the correlation between predictive tests and reading achievement. The study also shows that, of the factors considered, intelligence is the most significant in determining a child's success in first-grade reading. But when the four individual tests were combined with the mental test, the predictive power of the combination was greater than that of the mental test alone.

APPENDIX A

FIRST GROUP TEST OF READING ABILITY¹

Each pupil was provided with a sharpened pencil and a piece of cardboard 9 by 4 inches. The demonstration exercises for each of the four parts of this test were printed on a chart in letters large enough to be seen across the classroom. By use of a large sheet of paper to cover up part of the exercises on the chart it was possible to expose to view only the exercise that was being explained. Parts I and II of this test were given at one sitting and Parts III and IV at another sitting. The following questions and directions served as the general introduction to the test:

"Have you ever played games with words?" (Pause for answer.)²
"What is a game you have played with words?" (Pause for answer.)
"Did you like the game?" (Pause.) "We are going to play some nice games with words. In these games you must listen very carefully to what I say, you must not look at any one else's paper, and you must not say anything out loud unless I tell you to. When I say, 'Look at me,' you must do it right away."

PART I. WORD AND PHRASE RECOGNITION³

The directions and the exercises for Part I of the first group reading test follow:

(The examiner stands by his chart at the front of the room with the pupils' attention directed toward him.) "Now watch what I do. I pull this big sheet of paper down so I can see some words with a black mark under them. Now you take your card and put it on your paper so you can see just the words at the top and the black mark under them." (The examiner illustrates what is to be done with a test paper and a card. See that all children get their cards on the test paper properly.) "Now all of

¹The test papers for the first and second group tests of reading ability were prepared with a primer typewriter which had type considerably larger than the ordinary typewriter.

²Descriptions of what is to be done are enclosed in parentheses. What is to be said is indicated by quotation marks.

³This test was adapted from an unpublished study by Miss Elizabeth Long conducted under the supervision of Dr. Bess V. Cunningham, of Teachers College, Columbia University.

you put your finger on the first word, like this.” (The examiner puts his finger on the first word of the first exercise. See that pupils put their fingers on the proper word.) “What does the first word ‘say’?” (Call on one child to answer.) “Put your finger on the next (second) word. What does this word ‘say’?” (Have one child answer.) “Put your finger on the next (third) word. What does this word ‘say’?” (Have just one child respond to each question in the remainder of the directions.) “Now let’s find the word that ‘says’ *pig* and make a mark around it.” (The examiner points to the first word in the exercise.) “Shall we make a mark around this word? No, because it does not ‘say’ *pig*. Shall I make a mark around this word (pointing to the second word)? Now you find the word on your paper that ‘says’ *pig* and make a mark around it.” (See that all the children make the mark around the correct word.)

(The examiner taps on the chart to attract the attention of the pupils.) “Look at me. Watch what I do.” (The examiner lowers the blank sheet of paper on the chart so the pupils can see the second exercise.) “Now move your card down so you can see some more words and the black mark under them.” (See that pupils adjust card properly.) “Now look at all these words carefully and see what they ‘say.’” (Pause.) “Look at me. Let’s find the word that ‘says’ *cat* and make a line around it. Shall I make a line around this word (pointing to the first word)? No, because it does not ‘say’ *cat*. Shall I make a line around this word (pointing to the second word in the exercise)? No, because it does not ‘say’ *cat*. Shall I make a line around this word (pointing to the third word)? No, because it does not ‘say’ *cat*. Shall I make a line around the last word? Yes, because this word ‘says’ *cat*.” (Examiner makes a heavy line around last word.) “Now you make a line around the word on your paper that ‘says’ *cat*.” (See that pupils encircle the correct word.)

The third and fourth exercises are demonstrated in the same way as the first two except that the word *story* is used to refer to each of the four groups of words that comprise the exercise. After the demonstration has been completed proceed with the other exercises. The formula for each exercise is, “Find the word, or story as the case may be, that ‘says’” The words and phrases to be marked in the various exercises are given below. They are numbered to correspond to the exercise in which they are found.

- | | |
|------------|--------------------|
| 1. pig | 13. candle |
| 2. cat | 14. ran |
| 3. My pig | 15. He is out |
| 4. the cat | 16. Came to me |
| 5. Red | 17. I will help |
| 6. boy | 18. Did you eat |
| 7. go | 19. make a chair |
| 8. who | 20. I would jump |
| 9. was | 21. and she did |
| 10. grass | 22. you are crying |
| 11. cry | 23. he was there |
| 12. home | 24. They will help |

1. hen	pig	cut	called
2. my	goat	he	cat
3. My pig	she did	he is there	my bed
4. they went	he did	the cat	her house
5. Red	was	no	rabbit
6. they	make	boy	some
7. came	go	out	of
8. again	lived	home	who
9. will	help	was	he
10. grass	and	grew	then
11. chairs	cry	stop	got
12. why	on	her	home
13. are	after	candle	want
14. ran	you	said	help
15. he will	He is out	there was	out again
16. Came to me	her bed	came along	soon after
17. I was	stop crying	help me	I will help
18. did she go	my boy	Did you eat	she did
19. go out	make a chair	one bed	make a noise
20. I would jump	I came	why go	are you there
21. she was	they did go	help me	and she did
22. not there	you are there	you are crying	help me
23. her bed	he was there	he is at home	why cry
24. They will help	my boy said	they had help	out again

PART II. WORD RECALL

The directions and exercises for Part II, Word Recall, of the test follow:

(Arrange the chart so the children can see only the first exercise.) "See these words (pointing to the exercise on the chart). Now put the card on your paper so you can see just the words at the top and the mark under them." (With a test paper and a card the examiner illustrates what is to be done.) "Look at me. What does this word (pointing to the first word on the chart) 'say'?" (Call on some one pupil to answer. Do this for the three remaining words of the exercise.) With the pupils' attention still on the chart say, "Let's find a word that tells something a goat does and make a mark around it. Shall we make a mark around this word (pointing to first word)?" (Have some one child answer each of the questions in the remainder of the directions.) "No, because *she* does not tell what the goat did. Shall we make a mark around this word (pointing to second word)? Yes, because 'ran' tells something a goat does." (Examiner makes a heavy line around the word *ran*.) "Look at the words on your paper. Find the one that tells what the goat did and make a mark around it." (See that pupils encircle the correct word.)

"Now pull your card down so you can see some more words and the black mark under them." (Examiner illustrates with a test paper and a card.) "Look at all these words and see what they say." (Pause.) "Now we want to find a word that tells something a baby does and make a mark around it." (The examiner tells the pupils to look at the chart.) "Shall we make a mark around this word (pointing to first word)? No, because *he* does not tell what a baby does. Shall we make a mark around this one (pointing to second word)? No, because *then* does not tell what a baby does. Shall we make a mark around this one (pointing to the third word)? Yes, the word *cry* tells something a baby does, so we make a mark around this word." (Examiner makes a mark around the word *cry*.) "Now you find the word on your paper that tells what a baby does and make a mark around it."

This concludes the demonstration. In each of the remaining exercises the examiner should make sure that the pupils move the cardboard down when, and only when, they are told to do so. This enables the children to keep the correct place in the test. The statement which describes the condition to be fulfilled by the word that the pupil is to find is listed below for each exercise. The number of the statement corresponds to the number of the exercise with which it belongs. Each statement should be read slowly and distinctly twice in succession:

1. Find the word that tells something a goat does.
2. Find the word that tells something a baby does.
3. Find the word that tells something you can do.
4. Find the word that tells something you sleep in.
5. Find the word that tells something a boy can do.
6. Find the word that tells what people live in.

7. Find the word that tells something a goat eats.
8. Find the word that tells something that belongs in a house.
9. Find the word that tells something we sit in.
10. Find the word that tells the color of something.
11. Find the word that tells what the hen did to the wheat.
12. Find the word that tells who ate the bread.
13. Find the word that tells what the fox did.
14. Find the word that tells what the Little Red Hen found.
15. Find the word that tells what the Wee Wee Woman heard.
16. Find the word that tells what the Little Red Hen made from the wheat.

1. she	ran	shall	to
2. he	then	cry	into
3. after	again	eat	her
4. are	go	of	bed
5. No	there	jump	down
6. house	she	help	I
7. some	grass	she	help
8. are	why	stairs	one
9. on	soon	her	chairs
10. red	fox	house	old
11. cat	cut	they	came
12. woods	called	chicks	candle
13. cupboard	chairs	candle	came
14. wheat	was	will	want
15. noise	once	help	not
16. stopped	began	bread	bake

PART III. SENTENCE COMPREHENSION ⁴

The directions for Part III were like those for Part II except that the sentences comprising the exercises were referred to as "stories." The first two exercises were used for demonstration.

The statement which described the condition to be fulfilled by the story that the pupils should encircle in each exercise is given below. As in the case of the other parts of the test, the number of the statement corresponds to the number of the exercise.

1. Make a mark around the story that tells what the pig said.
2. Make a mark around the story that tells what the cat said.
3. Make a mark around the story that tells who began to cry.
4. Make a mark around the story that tells who wanted some grass.
5. Make a mark around the story that tells where the goat ran.
6. Make a mark around the story that tells who came along.
7. Make a mark around the story that tells where the old woman lived.
8. Make a mark around the story that tells what the Wee Wee Woman had.
9. Make a mark around the story that tells where the woman went.
10. Make a mark around the story that tells what the little boy had.
11. Make a mark around the story that tells who shall eat the bread.
12. Make a mark around the story that tells who cut the wheat.
13. Make a mark around the story that tells where the little boy wanted to go.

1. The pig ran. The pig said "Ouf." The goose said "Hiss."

2. The cat will go. The pig said "No." The cat said "Not I."

3. The goat went by. The rabbit began to cry. The boy went home.

4. The Hen wanted some bread. The old woman came out. The
goat wanted some grass.

5. The goat will eat grass. The goat ran into the woods. I saw the pig.

6. The boy saw nothing. The Little Red Hen did. The fox came along.

7. The Old Woman lived under a hill. The Old Woman was there.
The boy will help.

8. The Wee Wee Woman was there. The Wee Wee Woman had a bed.
The cat went under the bed.

⁴ See note 3 on page 47.

9. She called the pig. The rabbit went home. She went down stairs.
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10. The little boy had a goat. The little boy jumped. ran after the
goat.
-
11. The pig wanted some bread. The chicks shall eat the bread.
The boy had a goat.
-
12. The wheat grew. The boy jumped. The Little Red Hen cut
the Wheat.
-
13. The little boy is in the house. The little boy wanted to go home.
The goat ran.
-

PART IV. SENTENCE COMPREHENSION

The directions and exercises for Part IV, Sentence Comprehension, of the test follow:

(Arrange the chart so the children can see only the first exercise.) "Put your card on your paper so you can see some words that look like the words on this paper" (pointing to the chart). (Tap on the chart to attract the attention of all the children.) "Here is a little story (pointing to the sentence on the left), and here are some words in a little box (pointing to the words in the open rectangle at the right). Let's see what the words in the box say." (The examiner then points to each word in the rectangle while the pupils pronounce it. Have the pupils pronounce the words a second time.) "Let's see what the little story is about." (The examiner then points to the words in the story while the children read them aloud. Have them read it a second time.) "Now the story talks about one of the words in the box. Let's find the word in the box that the story talks about and make a mark around it." (The examiner points to the first word in the open rectangle.) "Shall we make a mark around this word?" (Ask some child to answer.) "No, because the story does not talk about *who*. Shall we make a mark around this word (pointing to second word)?" (Call on some one pupil to answer in the case of each question in the remainder of the directions.) "No, because the story does not talk about *down*. Shall we make a mark around the last word? Yes, because the story talks about *boy*. Look at your paper. Find the word in the box that the story talks about and make a mark around it." Use the first four exercises for demonstration. After the demonstration has been completed tell the pupils to finish all the exercises. There is no time limit, the pupils work as long as they can accomplish anything or until they have completed the test.

The score on each part of the test is the number of exercises correct.

1. The boy began to cry.	who	down	boy
2. The hen called the cat.	wheat	woods	hen
3. I want to eat some grass.	lived	goat	house
4. I ran after the goat.	fox	is	help
5. I will drive the goat home.	said	rabbit	are
6. She lived in a wee wee house.	wee wee	there	woman
7. I will make the bread.	was	Little Red Hen	is
8. I ran and jumped.	up	cut	rabbit
9. They make bread of me.	fox	wheat	the
10. I had a goat.	house	old	boy
11. I eat bread. I said "Meow."	cat	rabbit	fox
12. The woman looked under me.	along	there	chair
13. I will sting the goat.	then	bumblebee	did
14. I lived under the hill.	soon	out	Old Woman

15. A boy tried to sleep on me.

not

bed

red

16. She blew me out.

called

and

candle

APPENDIX B

THE INDIVIDUAL TEST OF READING ABILITY

After the examiner had asked a few miscellaneous questions for the purpose of establishing friendly relationship and minimizing embarrassment, the child was asked if he liked stories. He was then presented with the first selection—a passage copied from the textbook used and was asked to read it as well as he could. If a child hesitated as long as five seconds about pronouncing a word, the examiner pronounced the word and indicated the fact on the scoring sheet. All words mispronounced and those inserted were also recorded.

The first selection, a passage copied from the textbook used, was as follows:

A Little Boy had a goat.
The goat ran into the woods.
He found some grass.
The goat wanted to eat the grass.
The Little Boy wanted to go home.
The goat would not go home.
Then the Little Boy began to cry.

The three comprehension questions based upon this passage were as follows:

1. Where did the goat run?
2. What did the goat find?
3. What did the boy do when the goat would not go home?

The second passage was composed from words that had been thoroughly studied:

Once there was a pig.
The pig had some wheat.
A hen wanted the wheat and said, "Pig, I want some wheat."
The Pig said, "This is my wheat. I will eat the wheat."
A bumblebee flew by.
The bumblebee said, "I will sting the pig. Then he will go home."
The pig heard this and ran home.
Then the hen had some wheat to eat.

The three comprehension questions based upon this passage were:

1. What did the pig have?
2. Who wanted the pig's wheat?
3. Why did the pig run home?

APPENDIX C

SECOND GROUP TEST OF READING ABILITY

Each pupil was supplied with a pencil, a test paper, and a piece of cardboard 9 by 4 inches. After assigning to each assistant the group of students he was to supervise, the examiner then proceeded with the test according to the following directions:

"Put the card on your paper so you can see just the story at the top, like this." (Examiner illustrates with a test paper.) "Read the little story." (Call on some one pupil to read the story.) "Is the story a true story? Do you eat Bread?" (Call on one pupil to answer.) "Yes, this is a true story, so we will not do anything to it. Pull your card down so you can see the next little story." (Examiner should see that the pupils do not pull the cards down too far.) "Read this little story." (Call on some one by name.) "Is this a true story? Can a pig run?" (Call on some one pupil to answer in the case of each question in the remainder of the directions.) "Yes, this is a true story, so we will not do anything to it because it is a nice, true story. Pull your cards down so you can see the next story. Read this story." (Call on some one pupil to read the story.) "Is this a true story? Is a pig a cat?" "No, this is not a true story. A pig is not a cat. Take your pencil and mark it out." (Examiner illustrates by making a line through the sentence on a test paper.) "What do we do to a story when it is not a true story? That's right. We make a mark right through the story when it is not a true story. What do we do to a story when it is a true story? We do not make a mark when it is a nice, true story."

The same procedure is carried out for the first ten exercises, stopping two or three times to generalize about what is done to stories that are true and stories that are not true. When the first ten exercises are demonstrated, explain to the children that they are to go ahead and complete all the exercises. There is no time limit on the test, the students being permitted to work with the exercises as long as they seem to be accomplishing anything. The score is the number of exercises correct minus the number of exercises wrong.

I eat bread.

A pig can run.

A pig is a cat.

I can run.

The fox ran after the goat.

I eat grass.

I sleep on a bed.
The wheat said, "Ouf."
The man went home.
The Little Boy said, "Meow."
I was in the bread.
A Little Boy can cry.
A dog will eat a chair.
The Little Red Hen found some wheat.
I sleep on a rabbit.
I want to eat a house.
The Gingerbread Boy upset the pan.
I can sting a man.
I blew the woods away.
I want to eat some Gingerbread.
I heard the hill go down stairs.
The Old Woman lived under the hill.
The woman lived in the cat.
The man went into the candle.
The wheat grew.
The hill came into my house.
The woman lived in a little house.
A goat tried to sleep in my bed.
The chair made me a gingerbread boy.
I can go up hill.
The woman heard a noise in the night.
Grass is red.
You can put a candle on the table.
A boy can not eat.
I want to cut my mouth.
A goat will eat grass.
I jumped over the house.
It is night now.
The stairs are in the house.
Grass is green.
I am a baby.
A bumblebee can fly.
I can catch a ball.
A boy has three eyes.
A boy likes a little dog.
A bird likes to play ball.
A boy can eat.
I go to school with a rabbit.
A bird can sing.
The ground is warm in winter.
When there is snow it is warm.
The boy can play.
A boy has two eyes.
Snow is green.

It snows in the winter.
A nest can run and play.
The little boy flew like a bird.
A hen can lay an egg.
A man has four feet.
A bird can go over the house.

APPENDIX D

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VITA

ERBY CHESTER DEPUTY was born in Paris, Indiana, November 7, 1896, and completed the high school course at Scipio, Indiana, in 1913. He attended the University of Indiana for three years. During the years 1916 and 1917 he served as a chemist for the Carnegie Steel Company at New Castle, Pennsylvania. He was graduated from the University of Denver, Denver, Colorado, receiving the Bachelor of Arts degree in 1922. During the World War he spent two years in the United States Army, thirteen months of which were spent in oversea duty. He entered Teachers College, Columbia University, in September, 1924, and received the Master of Arts degree in June, 1925. He was matriculated as a candidate for the degree of Doctor of Philosophy in January, 1929.

His professional experience has been as follows: Rural school teacher in the schools of Jennings County, Indiana, 1913-14. Principal of a township high school, Jennings County, Indiana, 1919-21 and 1922-23. Principal of the high school, Bremen, Indiana, 1923-24. Instructor in educational psychology, University of Arkansas, 1926-28. Appointed to the position of Assistant Professor of Education and Assistant Director of the Bureau of Measurements and Standards, Kansas State Teachers College, Emporia, Kansas, September, 1929.

